# Discovery and Delivery of Space Geodetic Data Products from Distributed Archives

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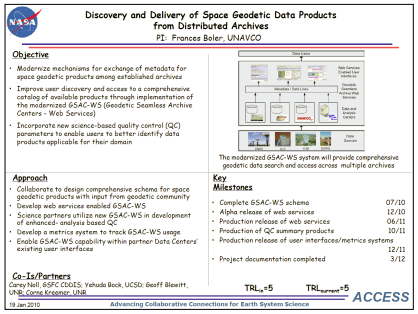
## Goals and Objectives

Three geodesy Archive Centers, Scripps Orbit and Permanent Array Center (SOPAC), NASA's Crustal Dynamics Data Information System (CDDIS) and UNAVCO are engaged in a joint effort to define and develop a common Web Service Application Programming Interface (API) for accessing geodetic data holdings. This effort is funded by the NASA ROSES ACCESS Program to modernize the original GPS Seamless Archive Centers (GSAC) technology which was developed in the 1990s. A new web service interface, the GSAC-WS, is being developed to provide uniform and expanded mechanisms through which users can access our data repositories. In total, our respective archives hold tens of millions of files and contain a rich collection of site/station metadata. Though we serve similar user communities, we currently provide a range of different access methods, query services and metadata formats. This leads to a lack of consistency in the user's experience and a duplication of engineering efforts.

The GSAC-WS API and its reference implementation in an underlying Java-based GSAC Service Layer (GSL) supports metadata and data queries into site/station oriented data archives. The general nature of this API makes it applicable to a broad range of data systems. The overall goals of this project include providing consistent and rich query interfaces for end users and client programs, the development of enabling technology to facilitate third party repositories in developing these web service capabilities and to enable the ability to perform data queries across a collection of federated GSAC-WS enabled repositories.

A fundamental challenge faced in this project is to provide a common suite of query services across a heterogeneous collection of data yet enabling each repository to expose their specific metadata holdings. To address this challenge we are developing a "capabilities" based service where a repository can describe its specific query and metadata capabilities. Furthermore, the architecture of the GSL is based on a model-view paradigm that decouples the underlying data model semantics from particular representations of the data model. This will allow for the GSAC-WS enabled repositories to evolve their service offerings to incorporate new metadata definition formats (e.g., ISO-19115, FGDC, JSON, etc.) and new techniques for accessing their holdings. Building on the core GSAC-WS implementations the project is also developing a federated/distributed query service. This service will seamlessly integrate with the GSAC Service Layer and will support data and metadata queries across a collection of federated GSAC repositories.




## Project web site

http://facility.unavco.org/data/gsacws/

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## Current Status

In August 2011 the project team launched 3 full featured production GSAC repositories and an instance of the Federated GSAC repository. The software and working implementations are the core deliverables for this ACCESS project:

| | |
|---|---|
| CDDIS | http://cddis.gsfc.nasa.gov/gsacws/gsacapi |
| SOPAC | http://geoappdev02.ucsd.edu:8080/gsacws/gsacapi |
| UNAVCO | http://facility.unavco.org/gsacws/gsacapi |
| Federated | http://facility.unavco.org/gsacfederated/gsacapi |

Further, to illustrate the ease of reuse of the GSAC repository software, we have developed a prototype GSAC proxy to the Incorporated Research Institutions for Seismology (IRIS) site search API. This implementation shows the potential use of the GSAC software for cross-disciplinary archive access.

http://facdev.unavco.org/gsaciris/gsacapi

We have also released the GSAC command line client and have developed a GSAC RAMADDA plugin for ingest and search of real-time GNSS streams. The core GSAC Service Layer (GSL), command line client, Federated repository and GSAC/ RAMADDA source code are made available via SourceForge:

http://sourceforge.net/projects/gsac/

University of Nevada Reno is now producing new daily QC product files for over 9000 GNSS sites.

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## Sustainability

Each of the participating archive centers are incorporating the GSAC repository instances into their core systems and user interactions. Furthermore, other organizations are expressing interest in adopting and making use of the core GSAC Service Layer. All of the general source code is well documented and made available via a SourceForge project.

## Next Steps

- Ingest UNR product files into UNAVCO archive
- Finish the real time stream support - search, metadata, ingest
- Port UNAVCO's Data Archive Interface (DAI) to use new GSAC API
- Implement stand-alone GNSS repository for 3rd party sites
- Continued engagement with our user communities
- Finalization of our metrics analysis process

## Presentations

Blewitt, G. and C. Kreemer, A System to Produce Precise Global GPS Network Solutions for all Geodetic GPS Stations in the World, 2010, Eos Trans. AGU, Fall Meeting Suppl., Abstract G22A-02.

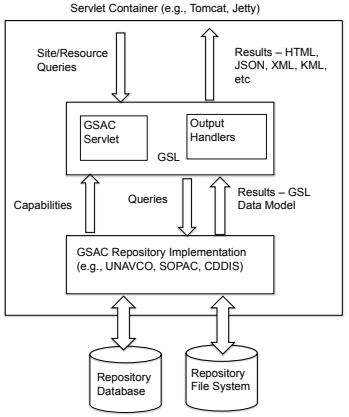
Boler, F., C. Noll, Y. Bock, C Kreemer, and G. Blewitt, Discovery and Delivery of Space Geodetic Data from Distributed Archives, Poster presented at the IGS Infrastructure Meeting, 2010.

Boler, F., G. Blewitt, C. Kreemer, Y. Bock, C. Noll, J. McWhirter, P. Jamason, and M. Squibb, Geodetic Seamless Archive Centers Modernization – Information Technology for Exploiting the Data Explosion, 2010, Eos Trans. AGU, Fall Meeting Suppl., Abstract G23B-827.

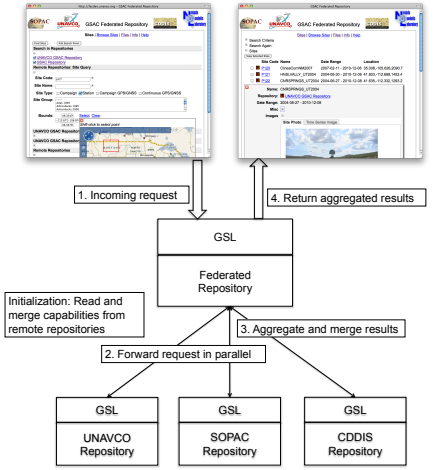
McWhirter, J., F. Boler, Y. Bock, P. Jamason, M. Squibb, C. Noll, G. Blewitt, and C. Kreemer, The Geodetic Seamless Archive Centers Service Layer: A System Architecture for Federating Geodesy Data Repositories, 2010, Eos Trans. AGU, Fall Meeting Suppl., Abstract IN11B-1085.

McWhirter, J., F. Boler, Y. Bock, M. Squibb, and L. Ratzesberger, An Open Source Framework for the Rapid Development of Data Archive Access Services, 2011, Eos Trans. AGU, Fall Meeting Suppl., Abstract IN23B-1457.

## GSAC Repository Architecture




## GSAC Federated Search Architecture



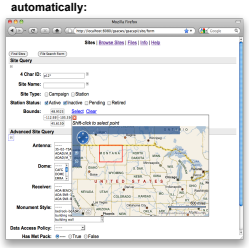

## GSAC Capabilities – An Alternative to OpenSearch

**A type based mechanism to describe what can be searched for in a repository:**

```
<repository name="UNAVCO GSAC Repository"
        url="http://facdev.unavco.org:8080/gsacws/gsacapi">
  <capabilities name="Site Search"    type="site"
    url="http://facdev.unavco.org:8080/gsacws/gsacapi/site/search">
    <capability id="site.code"  label="Site Code"     type="string"/>
    <capability id="site.type"  label="Site Type"     type="enumeration">
      <value id="Campaign"/>
      <value id="Station"/>
    </capability>
    <capability id="resource.datadate"  label="Data Date"
type="date_range"/>
    <capability  id="resource.filesize"     label="File Size"
type="number_range"/>
    ...
```

Types include:
- String
- Enumeration
- Date range
- Geospatial bounds
- Numeric range
- Boolean

**HTML form and browse interfaces generated automatically:**



**Web service API documented automatically:**